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Interactive comment on "Trichodesmium and nitrogen fixation in the Kuroshio" *by* T. Shiozaki et al.

Anonymous Referee #2

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General Comments:

The main question posed in this manuscript seems to be whether observations support the hypothesis that nutrient supply through transport from the Ryukyu Islands fuels growth of Trichodesmium in the Kuroshio. The authors do not find evidence of a gradient in phosphorus and iron between the Islands and the Kuroshio. They do find elevated Trichodesmium abundances near the Ryukyu Islands and conclude that Trichodesmium grows in that region and is transported downstream to the Kuroshio. This is an interesting and significant result. However, the major evidence presented in support of this process is a series of numerical simulations demonstrating advection of particles from the Islands to the Kuroshio. Quantitative analysis of the simulations is not presented. Since this piece of evidence is so crucial to the paper, it should be

evaluated and presented more thoroughly and quantitatively. The nutrient dynamics of the region and potential nutrient supply mechanisms could also be treated more thoroughly. Additionally, the manuscript would benefit from further revisions to improve organization, clarity, and flow. I have included some specific detailed comments below.

Specific Comments:

Abstract:

The major conclusion seems to be that Trichodesmium may be advected into the Kuroshio from the Ryukyu Islands, but this is not clear from the abstract.

Introduction:

p.11063 lines 1-8: What is the relevance to the present study? This section could be shortened.

p.11063 lines 28-29: "Phosphorus would ultimately limit diazotrophy because phosphorus in oligotrophic regions is consumed by diazotrophs, and is thus depleted." This sentence seems inaccurate, or at best, poorly worded, and could be removed. The discussion of previous findings related to the distribution of phosphorus in the region could be expanded.

Materials and Methods:

p. 11067 lines 26-28: The distribution of Trichodesmium with depth can vary significantly. Perhaps the data from all depths could be presented where available.

p.11068 Section 2.3: Please provide more details on the methods used for the numerical experiments. What particle-tracking methods were used?

p.11068 lines12-13: "The particle distribution at the surface was fixed throughout the experiment." What does this mean?

Results: p.11068 line 24-p.11069 line 1: "The algal bloom frequency was consistently

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> 10% in the west of the main stream of the Kuroshio because the average chl a was > 0.15 mg/m-3." Please clarify.

p. 11070 lines 3-8: Can the authors provide further justification for the basis of the analysis on surface Trichodesmium abundance? Perhaps a plot of depth-integrated vs. surface Trichodesmium abundance could be included.

p. 11070 lines 25-27: Can the direction of the currents be verified with data?

p. 11071 lines 24-28: Quantitative analysis could strengthen the manuscript. For instance, what is the likelihood a trajectory starting in the island region will end up in the Kuroshio, based on the simulations? Also, to what extent does the start time influence the results?

p.11073 line 17-p.11074 line 2: Please reword for clarity. Also, here iron is referred to as "the limiting nutrient", but phosphorus may also play a role.

p.11074 lines 13-15: This doesn't make sense. Do you mean "contribute to" rather than "be attributed to"?

p.11074 lines 15-22: The conclusion that "physical conditions" were similar in all regions based on consistent MLDs seems like a bit of a stretch. Perhaps the authors could reword this to make a more precise statement. Also, was there variation in N:P ratio among the regions analyzed?

p.11074 line 27 - p. 11075 line 1: What is the "inconsistency" between Trichodesmium abundance and iron and phosphate concentrations and how is it explained by the preceding part of the sentence?

p. 11075 lines 4-7: delete "This is because"

Interactive comment on Biogeosciences Discuss., 12, 11061, 2015.